within its centre a sudden display of very minute but richly coloured Newtonian rings, formed in this case by interior reflected light, although transmitted light was then being employed.

It is not absolutely necessary that a plate of glass with precisely parallel sides be used. A wedge can be manipulated if a particular spot be chosen and the wedge be most carefully adjusted to the same position by means of the stop and ledge on the stage. Less difficult, however, is glass formed into a plano-convex lens of long focus, the plane side being placed downwards, and the same point, the summit if possible, being always selected for observation: better still if a slice be cut off so as to present a secure fixing of the lens in the same position.

A variety of substances formed into plates, wedges, or lenses, with little convexity, may thus be examined, as also fluids enclosed between parallel plates.

V. "Description of a Mammalian Ovum in an early condition of Development." By Edward Albert Schäfer, Assistant Professor of Physiology in University College, London. Communicated by Dr. Sharpey, F.R.S. Received March 8, 1876.

[Plate 10.]

The opportunities which present themselves for the acquisition of the ova of Mammalia during the early stages of development, and especially ova of the period during which the formation of the blastodermic layers is proceeding, are so rare that, although the subject has been under special investigation by more than one observer, all the stages of the process of formation have by no means as yet been described; and much remains to be discovered in connexion with this phase of development alone. It seems on this account desirable to publish observations bearing upon this question, although they are limited to two or three or even to a single ovum, since it is by collecting and comparing the results which have been arrived at by different observers that there will be the best chance of coming to a definite conclusion upon a subject which involves the knowledge of every progressive stage.

I have been induced by these considerations to furnish a short description of an early developing ovum (of the cat) which came into my hands now fully two years ago, but which I had continually deferred the account of in the hope of obtaining specimens a little more in advance with which to compare that which I already had. This expectation having, however, hitherto been disappointed, I think it better to communicate the description without further delay, as it may at least serve for comparison with the statements of other observers.

In a cat which had been just killed, I noticed on opening the abdomen

five scarcely perceptible swellings in the cornua uteri; and perceiving a corresponding number of corpora lutea upon the ovaries, judged that each swelling must contain an ovum. Removing the uterus and placing it in a weak solution of bichromate of potash, I proceeded carefully to slit open the cornua under the fluid with fine scissors. As each one of the above-mentioned dilatations was reached, a minute, beautifully clear, vesicular body floated out into the surrounding liquid; there was no sign of any adhesion to the uterine wall.

The vesicles were as nearly as possible similar in size and appearance, and a description of any one of them will serve for all. Their shape was oval, the long diameter measuring about $\frac{1}{7}$ inch, the short about $\frac{1}{15}$ inch, and the outline being perfectly smooth and even. Under a low power of the microscope the vesicle was distinctly seen to be bounded by a primitive chorion or thinned-out zona pellucida. No trace of villi or projections of any sort could be detected on its surface. Besides this envelope the wall of the vesicle was composed of what appeared a simple layer of flattened polygonal cells, closely lining the zona. But under a somewhat higher power a stratum of more deeply lying cells could, in some parts at least, be detected by focusing; moreover a shadow at one place midway between the poles of the oval appeared to point to the possibility of the existence of a slight thickening at this part, although a well-defined *shaded* area was, in no sense of the word, visible.

I was led to imagine that the "shadow" in question, or rather the thickening to which it was probably due, would be caused by the first beginnings of a mesoblast at this situation. But nothing more could be made out in the fresh condition, and the little vesicles (at least two of them, for the others were of less value for the purpose of sections, owing to the blastoderm having shrunk away at various places from the zona, and presenting a crumpled distorted aspect) were accordingly hardened in the usual way in very dilute chromic acid, stained with logwood and with carmine respectively, imbedded by the gum-process*, with the object of filling the cavity and thus supporting the enclosing parts and preserving them in their natural positions; and finally sections were made across the long axis of the oval, and were mounted in glycerine and examined.

A glance at the sections is sufficient to show that the blastodermic vesicle is in the bilaminar condition. There exist within the zona pellucida, or primitive chorion, two distinct layers, the section of each forming a complete circle, the whole structure, therefore, included by the zona being formed of two separate vesicles one within the other (Plate 10. fig. 1). The outer of these is of course the epiblast, the inner doubtless representing the hypoblast: we may speak, then, of an epiblastic and a hypoblastic vesicle. In none of the sections was there any trace

* A bad method for embryos; but I was at the time ignorant of Kleinenberg's excellent plan for effecting the same object. See Forster and Balfour, 'Elements of Embryology,' p. 249.

of an intermediate layer of cells or mesoblast. The epiblast closely lines the zona throughout; but the hypoblastic vesicle is considerably smaller, so that except at one part, where it comes into closer proximity than elsewhere with the epiblast, it is separated from the latter by a considerable interval, filled in the fresh condition by a clear fluid. This fluid would seem to be of a different nature from that which occupied the cavity of the hypoblastic vesicle, for the coagulum produced in it by the action of the hardening liquid has a much more granular appearance in the sections. Both epiblast and hypoblast throughout almost the whole extent are composed of a simple layer of flattened cells joined edge to edge. Those of the former are represented in fig. 2, as seen flat in a separated portion, those of the latter in fig. 3. Most of the epiblastic cells exhibit in a high degree a condition of the nucleus which is frequently met with in epithelial cells elsewhere—a tendency, namely, to become separated into a clear colourless part, and a highly refracting and usually somewhat irregular body, which readily becomes stained by the usual colouring reagents. This change is no doubt a post mortem effect, probably produced by the action of the reagents employed. The hypoblastic cells do not for the most part present this appearance; their nucleus remains large, round, and clear; and the cell-substance does not become stained as much as that of the epiblastic cells.

It was mentioned above that the epiblastic and hypoblastic vesicles come into closer proximity at one part of the circumference than elsewhere; even here, however, they do not come into actual contact. At this place they are no longer formed, as elsewhere, of a single layer of cells, but their component elements, besides being rounder in shape and smaller, are two or three deep, although not arranged in as many definite strata. Both layers are in consequence somewhat thickened just here, the thickening (which is most marked in the epiblastic vesicle) extending over an area of about $\frac{1}{60}$ inch in diameter; not sharply defined, however, but gradually shading off into the thin part. Both epiblast and hypoblast are, it may be repeated, perfectly well defined and distinct from one another here as elsewhere; and there are no cells to be seen which do not clearly belong to one or the other. Moreover they are not only separated by a small but obvious amount of the granular material (coagulated fluid) previously mentioned, but there is in addition an exquisitely fine pellicle, which in the sections appears as a mere line passing over and forming a definite boundary to the upper (outer) surface of the hypoblast at the thickened area. This membranous pellicle, for which I would venture to propose the name of *membrana limitans hypoblastica*, is, as made out in teased preparations, perfectly homogeneous, and continues so throughout its extent. It becomes stained slightly by carmine, but apparently not at all by logwood, and is probably to be looked upon as a cuticular formation produced by the hypoblastic cells. Whether the delicate pellicle may extend around the whole hypoblast in the natural

condition I am unable to say; in the sections, at any rate, it appears to terminate towards the periphery of the thickened area, and to have become curled somewhat away from the hypoblast.

I am not aware that a similar structure has yet been noticed in the early blastoderm of any animal; but its importance in this case in bounding the hypoblast is evident. Indeed, if it should be found that the membrane in question is of general occurrence in the mammalian germ, and that the first appearance of the mesoblastic cells occurs external to it, as from its proximity to the hypoblast there is little reason to doubt, the fact of the existence of such a film between the commencing mesoblast and hypoblast is strongly in favour of the view which derives the former from cells of the epiblast as against that which would assign to it a hypoblastic origin.

[Since writing the above I have been enabled, through the medium of the Royal Society Library, to see a recent number of the new 'Zeitschrift für Anatomie und Entwickelungsgeschichte,' which contains a paper by Hensen on the early stages of development of the rabbit's ovum. In sections of one blastoderm, of which he gives figures, there is a delicate line at the *anterior part* of the germinal area lying midway between the epiblast and hypoblast and marked *m.pr.* This is referred to in the Description of the Plate as "vielleicht die erste Anlage der *membrana prima*." Unfortunately, although all the figures appear to be given, the text of the paper is incomplete (the completion is promised in the next Number); and the full description of this blastoderm and the account of the so-called "membrana prima" are for the present altogether wanting.

But from Hensen's figure I have very little doubt that his "membrana prima" is a structure analogous with that described by me in the cat's ovum as "membrana limitans hypoblastica," although the position and relations of the membrane, especially with regard to the hypoblast, appear somewhat differently in our respective drawings. I think the name "membrana prima" is, however, by no means well chosen for the structure in question; for, leaving out of consideration the primitive chorion, do not the early embryonic cells (the products of segmentation) themselves compose the *first membrane*? as the very name which has been assigned to them collectively since the time of Pander itself directly implies.]

DESCRIPTION OF PLATE 10.

Fig. 1. Diagram of a vertical section across the middle of the developing ovum. Magnified.

z.p. Section of the zona pellucida or primitive chorion.

e.v. Vesicle formed by the epiblast.

h.v. Vesicle formed by hypoblast much smaller than the former.

g. Opposite the thickened portion of both layers (germinal area).

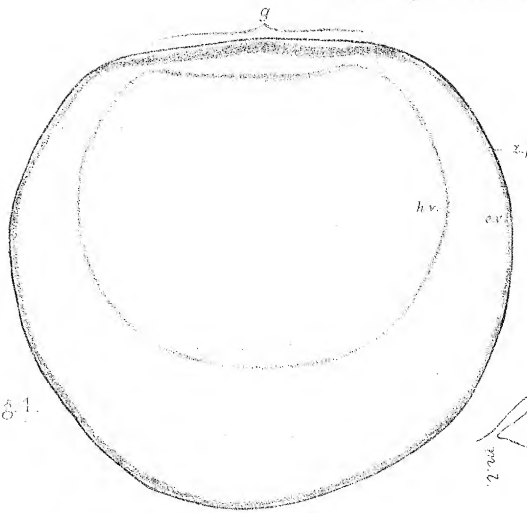


Fig. 1.

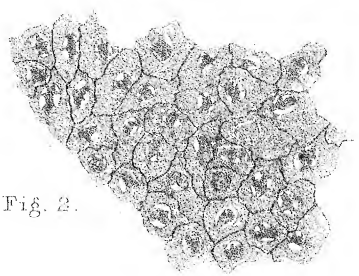


Fig. 2.

Fig. 3.

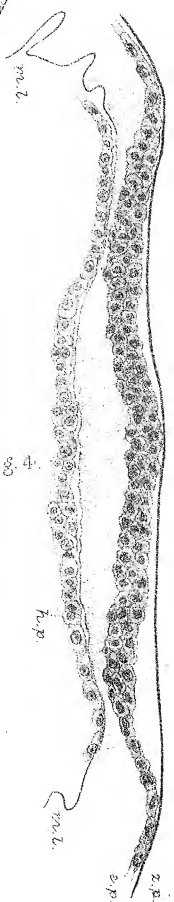


Fig. 4.

Fig. 2. Piece of the epiblast; the cells and nuclei stained with carmine. Magnified about 370 diameters.

Fig. 3. Piece of the hypoblast; similarly prepared. Magnified 370 diameters.

Fig. 4. Section across the germinal area of the developing ovum, stained with logwood. Magnified 200 diameters.

z.p. zona pellucida.
e.p. epiblast.
h.p. hypoblast.
m.l. Membrana limitans hypoblastica.

VI. "Preliminary Report to the Hydrographer of the Admiralty on some of the Results of the Cruise of H.M.S. 'Challenger' between Hawaii and Valparaiso." By Prof. Wyville Thomson, F.R.S., Director of the Civilian Staff on board. Received February 26, 1876.

[This Report will appear in a subsequent Number of Proceedings.]

March 30, 1876.

Dr. J. DALTON HOOKER, C.B., President, in the Chair.

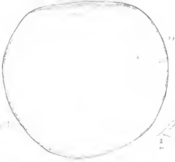
The Presents received were laid on the table, and thanks ordered for them.

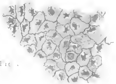
The following Papers were read:—

I. "An Experiment on Electro-Magnetic Rotation." By W. Spottiswoode, M.A., Treas. and V.P.R.S. Received February 24, 1876.

The phenomena of the rotation of movable conductors, carrying currents, about lines of magnetic force are well known. One form of experiment, commonly called the rotating spark, presents, beside the actual rotation, some peculiar features which do not appear to have been noticed in detail. The instrumental arrangements consist of a partially exhausted chamber with a platinum point for one terminal, a ring for the other, and the intervening air or other gas for the movable conductor. The chamber is made in the form of a double cylinder, so that a magnet inserted through the ring may reach nearly to the point. The discharge then passes between the point and the ring, and revolves about the magnet according to Ampère's law.

But beside the rotation, and even when, through weakening of the magnet, rotation does not actually take place, the spark, when carefully observed, is seen to assume a spiral form; and the spiral is right-handed or left-handed according to both the direction of the current and the mag-





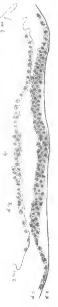


Fig 4